

Effectiveness of Lead Aprons in Positron Emission Tomography

Rodrigo Bezerra Fonseca*¹ and Ademir Amaral¹

¹*Grupo de Estudos em Radioproteção e Radioecologia – GERAR*

Departamento de Energia Nuclear

Universidade Federal de Pernambuco – Recife - Brazil

Abstract

In the last two decades, Positron Emission Tomography (PET) has emerged as clinical diagnostic technique, becoming one of the fastest growing imaging tools in modern nuclear medicine.

Because 511 keV annihilation photon energy is much higher than the photon with mean energy of 140 keV emitted in Single Photon Computed Tomography (SPECT), medical staff working in PET studies receive a higher dose than those working only with SPECT tracers do.

As a result, special attention must be paid to keep radiation exposure as low as reasonably achievable (ALARA principle).

Lead equivalent apron is the principal personal protective equipment for technologists occupationally exposed to ionizing radiation in medical procedures and may be an important component in the ALARA program.

However, in practices involving PET, 0.5 mm lead equivalent aprons have been used regardless of photon's energy. In this context, this work was designed for evaluating radioprotective effectiveness of such aprons in PET procedures.

For this, the operational quantities personal dose equivalent $H_p(0.07)$ and $H_p(10)$ have been assessed by using MCNP4C code in a model of individual exposure to small source of 511 keV photons, representing the situation of injection of the radiopharmaceutical, in two situations: technologists wearing and not wearing 0.5 mm lead aprons. To represent the technologist a mathematical anthropomorphic phantom was employed, and the simulated source to subject distances varied between 40 to 100 cm, in steps of 10 cm.

The results showed no significant differences between the values obtained for $H_p(10)$ in the two situations, pointing out that there is no radioprotective influence of wearing such aprons on PET practices.

Compared to simulations without such device, $H_p(0.07)$ increased up about 26% when technologist is wearing radioprotective aprons, depending on the source to subject distance.

On the basis of this work, 0.5 mm lead equivalent aprons should not be recommended as personal protective equipment for technologists in procedures for positron emission tomography.

KEYWORDS: *Lead apron; PET; MCNP; Monte Carlo; Nuclear Medicine.*

* Presenting author, E-mail: bezerrafonseca@hotmail.com